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door-chime driver

The bell-wiring-system in many blocks of flats consists of a set of pushes in the communal entrance hallway, a centrally-located (and inaccessible) transformer and a cheap-and-nasty trembler bell in each flat. One's own front door is then usually fitted with a kind of king-size bicycle-bell that requires considerable force to be applied to the push. Since the whole set-up is a minimum-price job, the available current is invariably too low to operate a full-length door-chime, particularly when the flat concerned is located on a higher floor. It is also not normally possible to connect a bell-push on the flat-door into the system. The circuit described here is the result of one engineer's taking up the gauntlet . . .

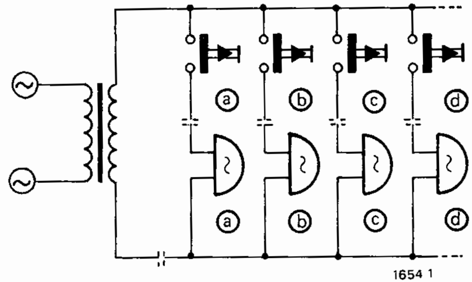

Figure 1, The original situation. The transformer and the bell-pushes (a, b, c, d . . .) are installed in the communal entrance hall.

The existing bell-system is typically wired as in figure 1. The transformer and the bell-pushes are installed in the main hall (or at the street-door), with only the ringing-lines and the common return being brought upstairs. In particular the 'hot side' of the transformer secondary is therefore inaccessible, except at the actual pushes. The solution is obvious: shunt a rectifier diode across the bell-push contacts, so that

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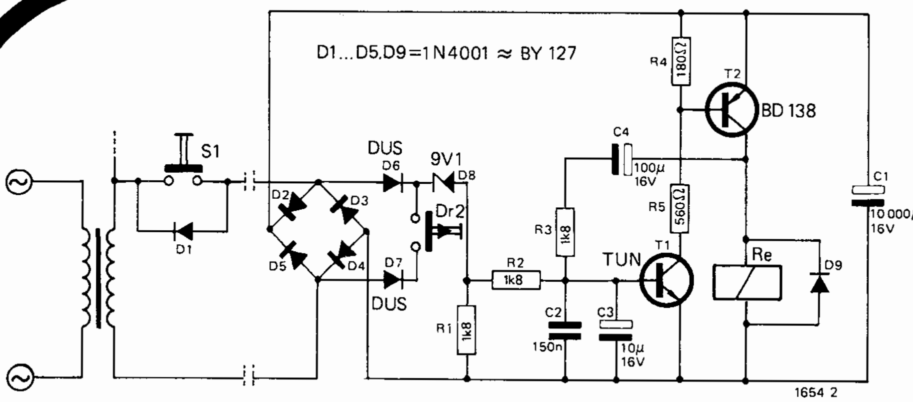

Figure 2. Circuit diagram of the complete door-chime driver. In the entrance-hall one only needs to mount D1 across the contacts of the bell-push corresponding to one's own flat; the remainder of the electronics is installed upstairs near the chime. S2 is an extra push that can be installed at the flat entrance, to replace the usual mechanical 'bicycle bell'.

one always has at least half-periods of the AC to play with upstairs. (Figure 2). The upstairs installation starts out with a bridge rectifier (D2 ... D5) and a large electrolytic capacitor (C1). This reservoir is charged, under standby conditions, almost to the peak value of the unloaded AC – typically to about 12 volts. The actual driver circuit is a monostable trigger that responds to the arrival of positive half-periods. These come in either through D6, when the downstairs push shorts D1, or through D7 and S2 (installed at the flat door). If D1 is connected in the opposite sense across the push S1 (it may not always be obvious which wire is which), the positive half-waves will come in continuously through D6. This is no cause for alarm (or for another trip downstairs) - one simply interchanges the incoming wires, so that D6 is connected to the common return and D7 to the ringing-line from S1.

The zenerdiode provides a high threshold at the input, so that interference pulses or the voltage drop in the common return (when someone elses bell is ringing) do not give a false signal.

The positive wave peaks pass through R2 to charge C2 and C3. When T1 is driven into conduction it will also turn on T2. Positive feedback through C4 and R3 will now turn T1 on further, so that the circuit quickly saturates. This applies power to the chime solenoid . . . 'Ding'.

C4 will now charge up through R3, providing a base current for T1 that will keep the circuit temporarily in saturation. The current through R2 on its own is not sufficient to do this, even when the push is held down. As C4 builds up a steadily higher voltage, the current through R3 will drop, until the point is reached at which T1 and T2 start to come out of saturation. The voltage at T2 collector now shifts slightly negative, causing a negative-going drive to be applied to T1 through R3 and C4. This further reduces the drive to T2 . . . so that the circuit rapidly turns off. 'Dong'.

The base of T1 has now been driven far negative, so that the circuit is blocked for several seconds - until C4 can discharge sufficiently through R3, R2 and R1. If one of the bell-pushes is held down the switch will re-trigger after this interval, so that the chime will play slowly but continuously:

'Ding . . . dong . . . ding . . . dong'.

The chime solenoid should be wound for 12-volt operation. If a 6-volt type is used the current surge will cause a far too violent 'ding' (the reservoir voltage being a given condition) - and T2 may be destroyed. The prototype circuit actually did use a 6-volt chime (Friedland) which happened to be on hand - but it was rewound for 12-volt operation. Inspection showed that the solenoid was fully wound with 0.3 mm diameter enamelled-copper wire (SWG 32) to a total resistance of 6 Ω. This winding was stripped and replaced by a full winding of wire-diameter 0.22 mm (SWG 36). The new solenoid had 30 Ω resistance and about the right number of 'ampere-turns'. A second choice solution would be to use a 6 Ω wirewound resistor (about 5 W) in series with the original solenoid - but this would call for a 25000 µF reservoir capacitor!

Note that D9, across the solenoid winding, prevents the rise of a back-voltage at turn-off which could (would) destroy T2. There is, incidentally, no reason why scrap-box 'germanium' transistors (such as AC 127/AC 128) should not be used - the circuit is fairly uncritical.

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